

Strength prediction and reliability of brittle epoxy adhesively bonded dissimilar joint

Abstract

This paper deals with strength and failure prediction as well as reliability issues of adhesive joints of brittle epoxy bonding of two dissimilar adherends. Effects of bond thickness and scarf angle upon the strength of such joints are also addressed. Three kinds of adhesive joints, i.e., butt, scarf and shear joints, are considered. It is found that the strength prediction of various adhesive joints under consideration can be done by establishing interface corner toughness, H_c , parameter. For adhesive joints with an interfacial crack, fracture toughness, J_c , or interfacial toughness, K_c , can be used as a fracture criterion depending on the fracture type observed. The predicted strengths based on these fracture criteria (i.e., H_c , J_c and K_c) are in good agreement with experimental data obtained. Weibull modulus is a suitable parameter to define the strength reliability of adhesive joints. From experimental data, scarf joint of 45 is identified to be preferable since it satisfies both outstanding load-bearing performance and tolerable reliability. In addition, the Weibull statistical method has made possible the strength reliability determination of non-cracked adhesive joints

Keywords

Bond thickness; Dissimilar adherends; Interface mechanics; Prediction Reliability; Singularity